Thoughts on Privacy

concepts and approaches

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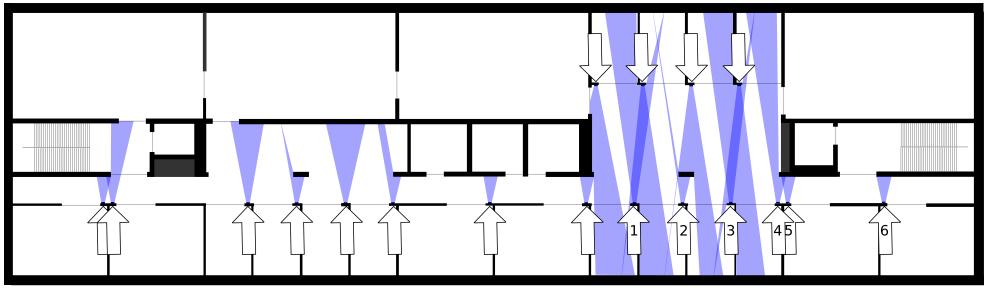
BREMEN SPATIAL COGNITION CENTER

Universität Bremen*

motivation

it's law... obey it

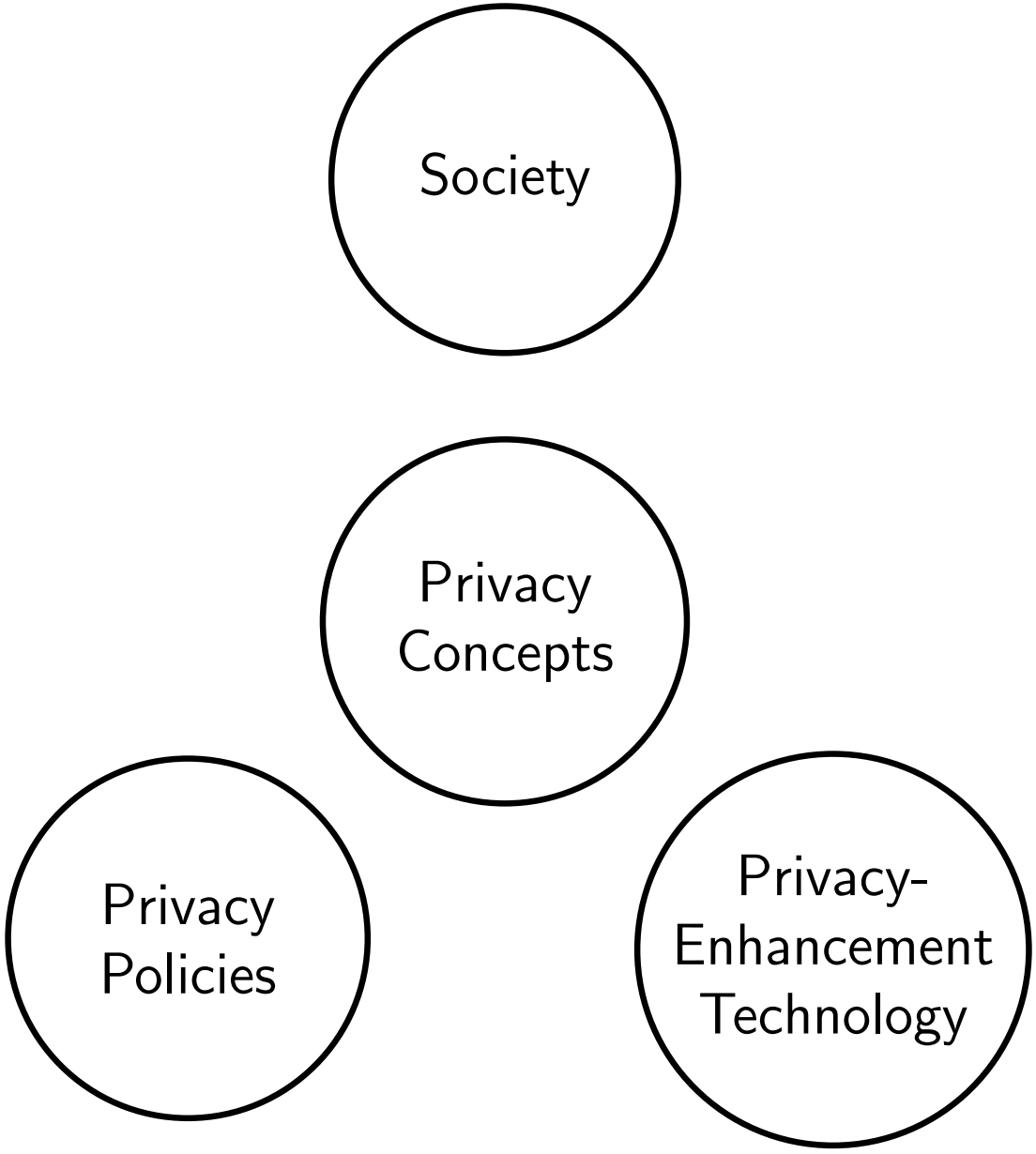
my motivation



ethics & privacy

(images are from google image search thumbnails)

privacy overview



society

(images are from google image search thumbnails)

privacy concepts

- Information Privacy
- Personal Privacy
- Territorial Privacy
- Location Privacy

privacy concepts

- Information Privacy ←
- Personal Privacy
- Territorial Privacy
- Location Privacy

accessibility and availability of information, including but not limited to personally identifiable information (PII) and sensitive personal information (SPI)

privacy concepts

- Information Privacy
- Personal Privacy ←
- Territorial Privacy
- Location Privacy

follows the concept of information privacy with a focus on personally identifiable information (PII) and sensitive personal information (SPI)

privacy concepts

- Information Privacy
- Personal Privacy
- Territorial Privacy ←
- Location Privacy

privacy as a spatial and temporal problem

privacy concepts

- Information Privacy
- Personal Privacy
- Territorial Privacy
- Location Privacy ←

explicitly addresses location information, i.e., information about the (current) location of an individual or entity

privacy policy languages

LANGUAGE		FOCUS: machine	human	privacy	security	ASPECTS: authorization	context	meta	spatial	temporal	user	enterprise	multi-party	law	SYNTAX: XML/RDF	high-level	logical	specific
...																		
P3P	(1999)	✓		✓		✓	✓		○[a]				✓[b]		✓			
CPEExchange	(2000)			✓		✓				✓		✓			✓			
APPEL (P3P)	(2001)	✓		✓		✓	✓				✓				✓			
E-P3P	(2002)	✓		✓		✓	✓					✓			✓			
EPAL	(2003)	✓		✓		✓	✓					✓			✓			
XPref	(2005)	✓		✓		✓	✓				✓				✓			
LPU/CI	(2006)	○		✓		✓	✓			✓			✓	✓			✓	
Privacy APIs	(2006)	✓		✓		✓	✓							✓		○	○	✓
P-RBAC	(2007)	✓	○	✓		✓	✓				✓	✓			✓			
PPL	(2009)	✓		✓		✓	✓			✓			✓		✓			
SecPAL4P	(2009)	✓	○	✓		✓	✓		✓[a]	✓			✓		✓		✓	✓
PrivacyLFP	(2010)	○		✓		✓	✓			✓				✓			✓	
AIR	(2010)	✓		✓				○[h]							✓[f]		○[g]	
S4P	(2010)			✓						✓			✓				✓	
Jeeves	(2012)	○		✓		✓							✓			✓	✓	
P2U	(2014)	✓		✓		✓	✓			✓[e]	✓				✓			
AAL/A-PPL	(2014)	✓	✓	✓	○	✓	✓		✓	✓			✓		○[l]			✓
...																		

29 Languages focusing on privacy and security policies from 1999 till 2014

privacy policy languages

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29 Languages focusing on privacy and security policies from 1999 till 2014

machine	22
human	5
privacy	18
security	12
authorization	26
context	16
meta	1
spatial	9
temporal	10
user	4
enterprise	11
multi-party	8
law	3
XML/RDF	19
high-level	6
logical	11
specific	7

privacy enhancing technology

- authentication
- accountability
- encryption
- obfuscation
- fragmentation
- data-hiding
- social means

privacy enhancing technology

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methods to validate and enforce a users authentication and authorization to access certain information

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allow to relate actions or information to specific entities

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methods to encrypt and decrypt information

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possibilities to prevent the complete disclosure of detailed information, but allows to present or access abstracted versions

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- authentication
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- fragmentation ←
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methods to distribute information in order to dissolve sensitive relational information

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- encryption
- obfuscation
- fragmentation
- data-hiding ←
- social means

methods to prevent the availability or visibility of information

privacy enhancing technology

- authentication
- accountability
- encryption
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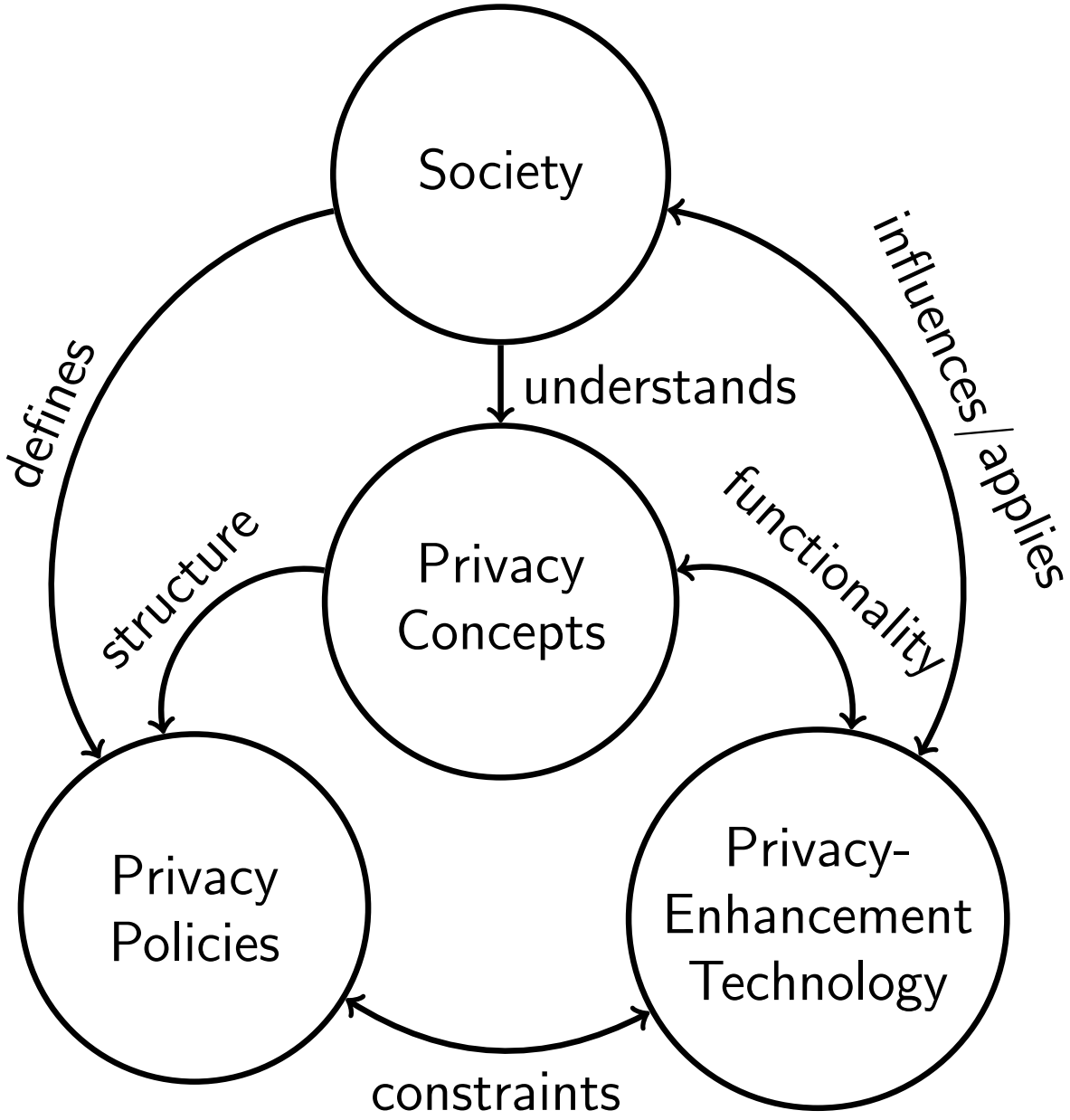
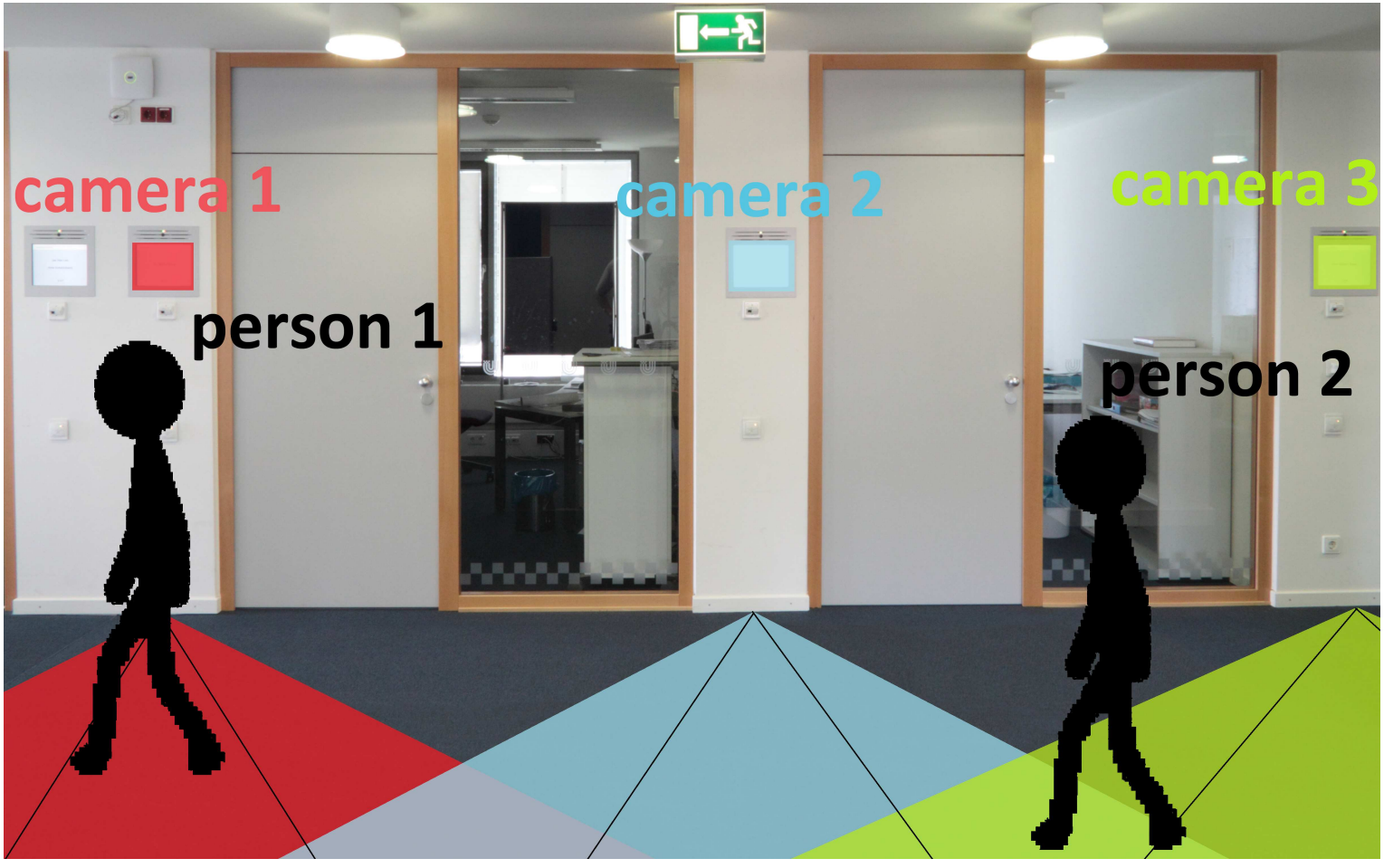
- social means ←

methods applied by a society to restrict and enforce actions conducted by other individuals or groups

privacy overview



privacy paradox



privacy as a service

knowledge vs support

- transparency
- responsibility
- privacy (violation) disclosure

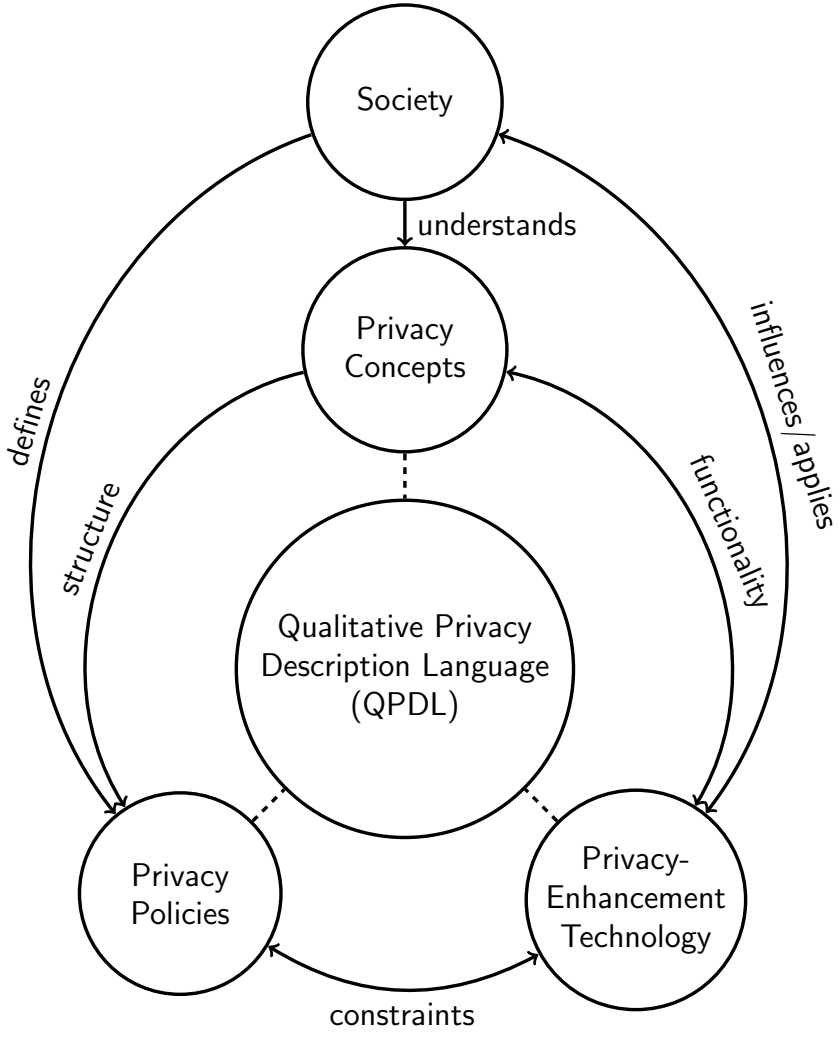
privacy affordances

how to deal with privacy violations in a system?

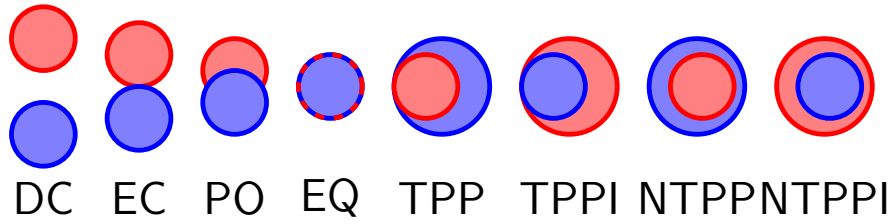
	detection	resolution	prediction	prevention
privacy oblivious systems				
privacy aware systems	✓			
privacy repairing systems	(✓)	✓		
privacy projecting systems	(✓)		✓	
privacy conserving systems	(✓)	✓	✓	
privacy shielding systems	(✓)	(✓)	(✓)	✓

() Implied by other privacy functionality used or possible, but without impact

QPDL



QSTR



temporal logics (LTL/ATL)

$\circ\phi$ (next)

$\Box\phi$ (always)

$\Diamond\phi$ (eventually)

$\phi\, U\, \psi$ (until)

$\phi\, R\, \psi$ (release)

QPDL

- spatial symbols ($\mathcal{S}$)
- qualitative relation symbols ($\mathcal{R}$)
- function symbols ($\mathcal{F}$)
- general propositional symbols ($\mathcal{G}$)

$$P := G \cup \{r(s,t) | r \in \mathcal{R}, s,t \in (\mathcal{S} \cup \{f(s_i) | f \in F, s_i \in \mathcal{S}\})\}$$

QPDL

$$\Pi := \bigcup_{i=1,\ldots,m} \pi_i$$

$$\pi_i = \{\phi_{i_1}, \phi_{i_2}, \ldots, \phi_{i_o}\}$$

$$\phi_{i_j} \rightarrow violated(\phi_{i_j})$$

$$violated(\pi_i) := \bigvee_{j=1,\ldots,l} violated(\phi_{i_j})$$

$$violated(\Pi) := \bigvee_{i=1,\ldots,m} violated(\pi_i)$$

QPDL

- $(knows(h_2, name(h_1)) \implies \neg knows(h_2, address(h_1))) \wedge (knows(h_2, address(h_1)) \implies \neg knows(h_2, name(h_1)))$
- $(knows(h_2, name(h_1)) \wedge knows(h_2, address(h_1))) \implies (in(h_1, r) \wedge in(h_2, r))$
- $stored(data) \wedge encrypted(data)$
- $\neg access(h, data) U\ valid\_code(h)$
- $(in(h_1, r) \wedge in(h_2, r)) \implies \circ(show(data, t) \wedge in(t, r))$

privacy vs security

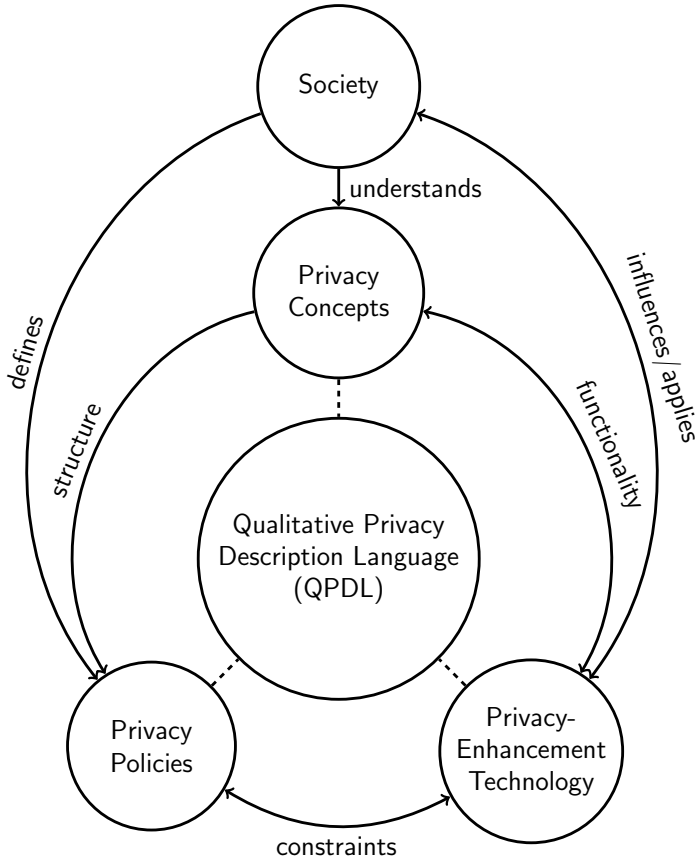
privacy

- data avoidance/thrift
- intention of use
- duration of existence

security

- authenticity
- integrity
- confidentiality
- availability
- non repudiation

summary



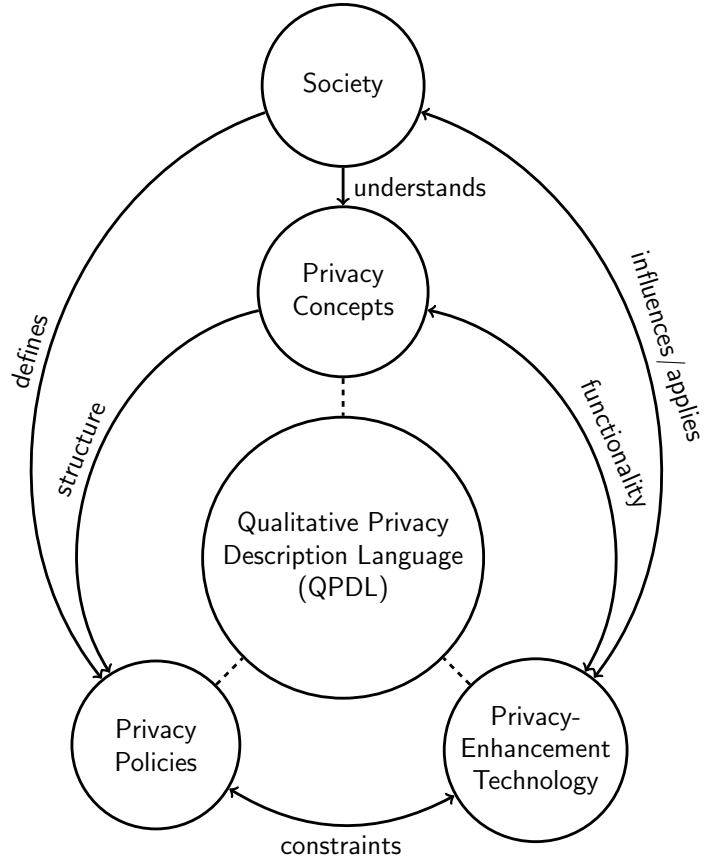
- concepts
- policy languages
- technologies
- paradoxes
- privacy as a service
- privacy vs security

take home messages

- privacy is important
- balance knowledge and support
- privacy is an opportunity
- privacy is a socio-technical problem

thank you!

- questions?
- comments?



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